Clear Creek Flood Damage and Ecosystem Restoration Study

It Takes a Community to Build a Community Model

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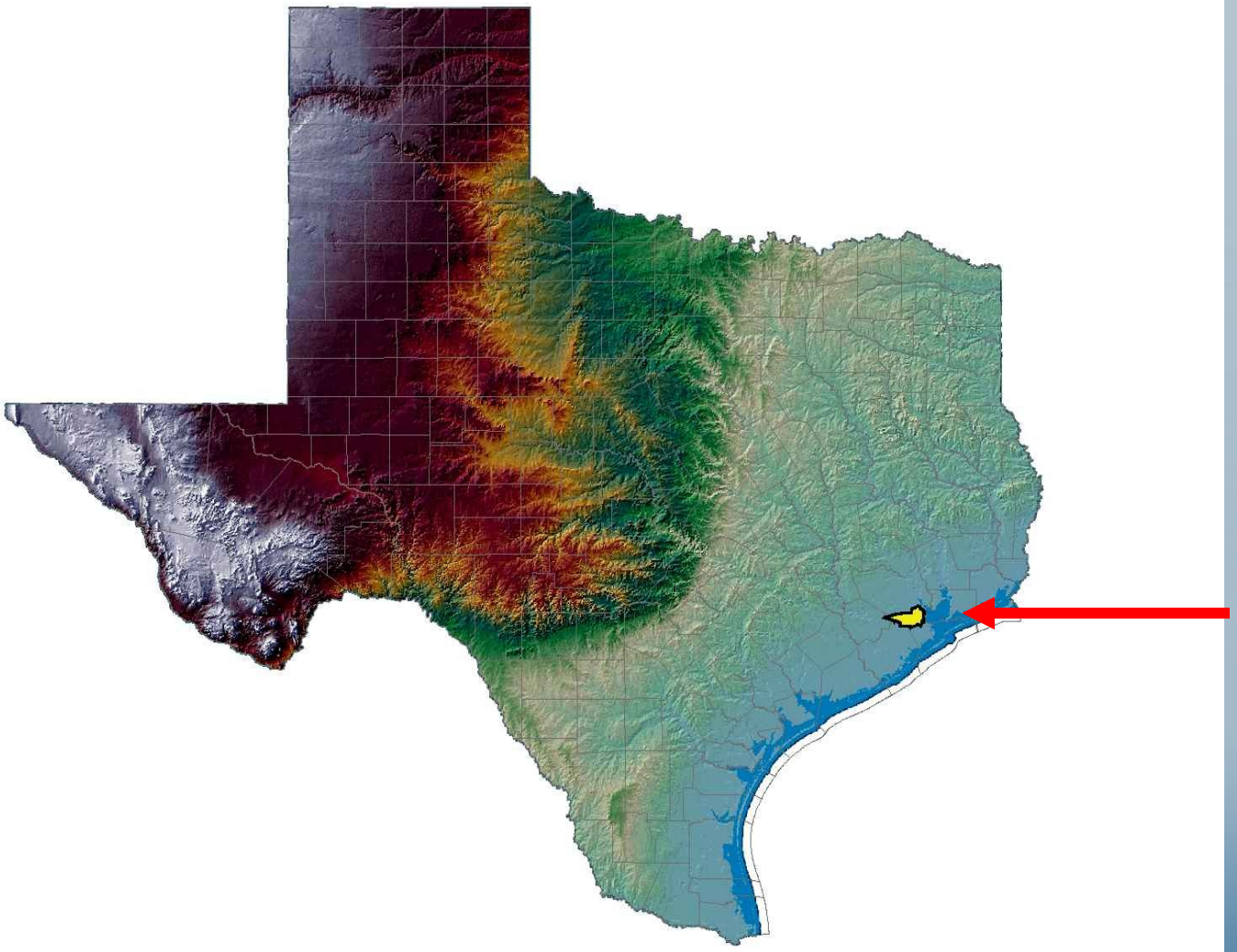
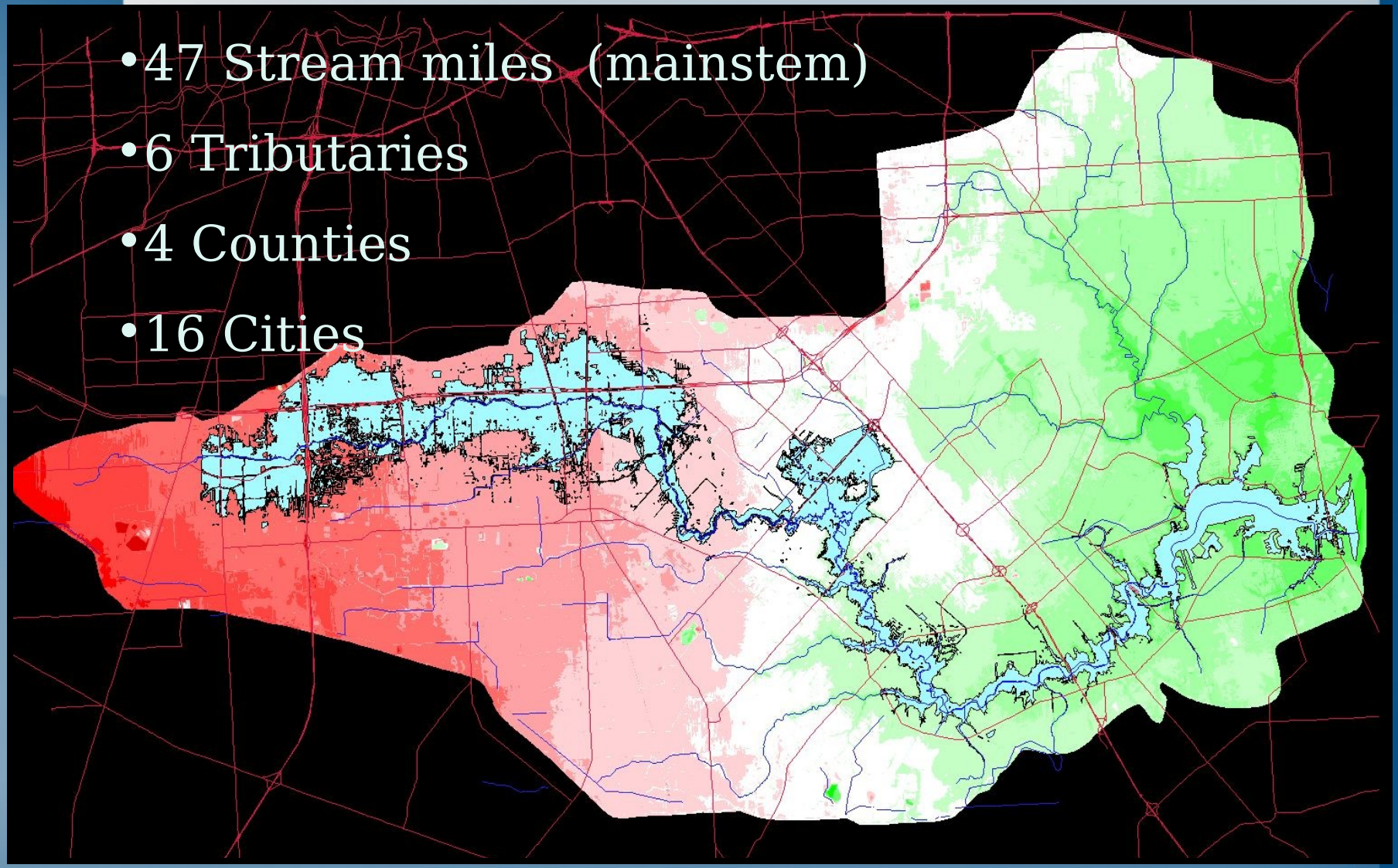
Project Location



Clear Creek Study Area



Flooding Problems

1944

TS Claudette, July 1979

TS Allison, June 2001

Environmental Problems

Loss and Degradation of Floodplain Forest, Wet Prair and Tidal Marsh

Study Goals

- Reduce riverine flood damages
- Maximize net excess economic benefits
- Minimize or mitigate environmental impacts
- Identify opportunities for ecosystem restoration

Interagency Coordination Team (ICT)

"The promotion of institutional acceptance across the spectrum." **J. Stokes, 2006**

- The Usual Suspects
  - Corps of Engineers
  - US Fish and Wildlife Service
  - National Marine Fisheries Service
  - Environmental Protection Agency
  - Natural Resources Conservation Service
  - Texas Commission on Environmental Quality
  - Texas Parks and Wildlife Department
  - Sponsors

- Ecosystem Assessment Team (E-Team)
  - Created **early** in the planning process
  - Sub-group of the ICT
  - Manned by representatives from the ICT
  - Facilitated by ERDC

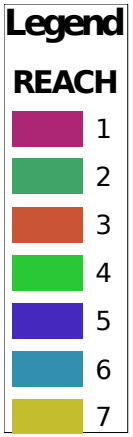
Rationale for Community Habitat Suitability Index (HSI) Models

- No single species identified as a “best representative species” for habitat
- A suite of 4 or 5 representative species meant 12 to 15 separate species-based HSI models
- Access to necessary research and expertise
- Community approach links habitat more broadly to ecosystem functions
- Similar to species models, Community models rely on field measured habitat parameters

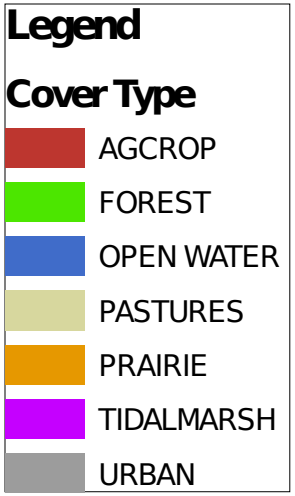
“Build it and they will come…”

Floodplain Forest Community Model

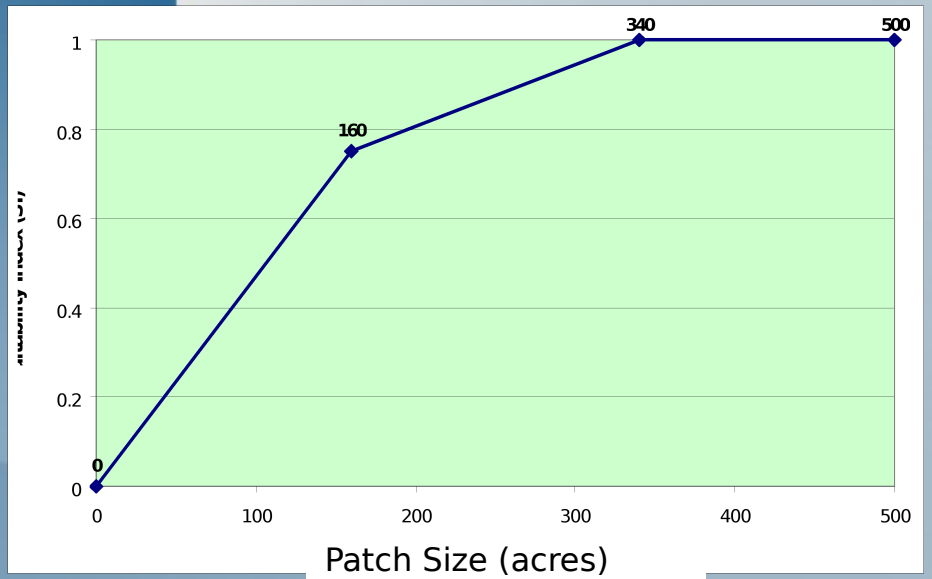
- Biotic Integrity Component
  - Variables
    - **Invasives**
    - **Structure**
    - **Substrate**
    - **Riparian Integrity**
- Hydrology Component
  - Variables
    - **Roughness**
    - **Sinuosity**
    - **Erosion Potential**
    - **Imperviousness**
- Landscape Component
  - Variables
    - **Patch Size**
    - **Core & Edge**
    - **Nearest Neighbor**
    - **Adjacent Landuse**

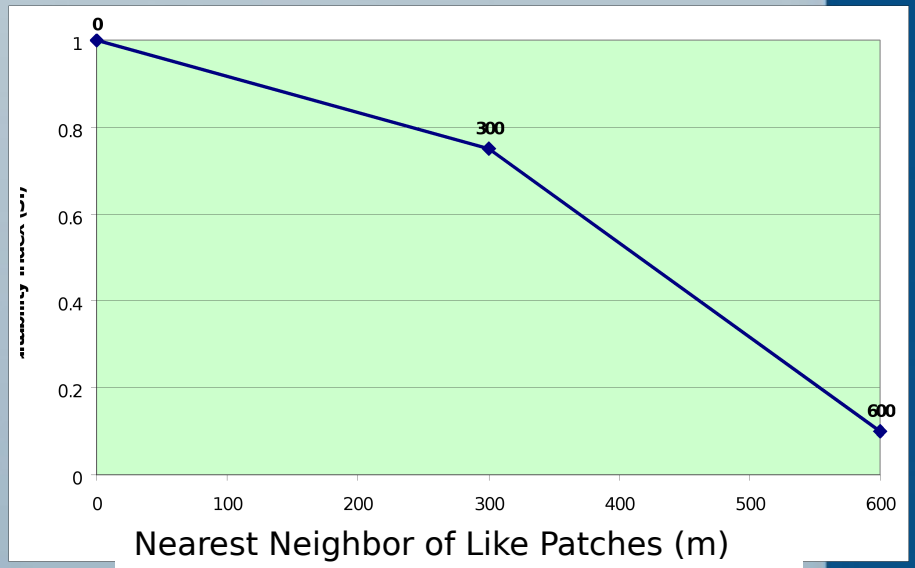

Legend
REACH
1
2
3
4
5
6
7

Cover Types


Legend
Cover Type
AGCROP
FOREST
OPEN WATER
PASTURES
PRAIRIE
TIDALMARSH
URBAN

Landscape Variables Suitability Index (VSI) Curves





- Suitability Indices are scaled from 0 to 1
- An SI score of 1 representing an optimum condition

Landscape component of the Floodplain Forest Community

Component (Life Requisite) Code	Variable Code	Applicable Cover Type Code(s)
FLANDSCAPE	PATCHSIZE	FOREST NEWFOREST
	CORE	
	NEIGHBOR	
	EDGE	
	ADJLANDUSE	

Life Requisite Suitability Index (LRSI) Formula

$$\left\{\left[\left(V_{PATCHSIZE} \times V_{CORE}\right)^{1/2} X \left(\left[\frac{V_{NEIGHBOR} + \left(V_{EDGE} \times V_{ADJLANDUSE}\right)^{1/2}}{2}\right]\right)\right\}^{1/2}$$

Floodplain Forest Community – Reach 5

Baseline Community HSI and HU Values

CSIs:
- Biota = 0.70
- Hydrology = 0.68
- Landscape = 0.44

} Community HSI = 0.606

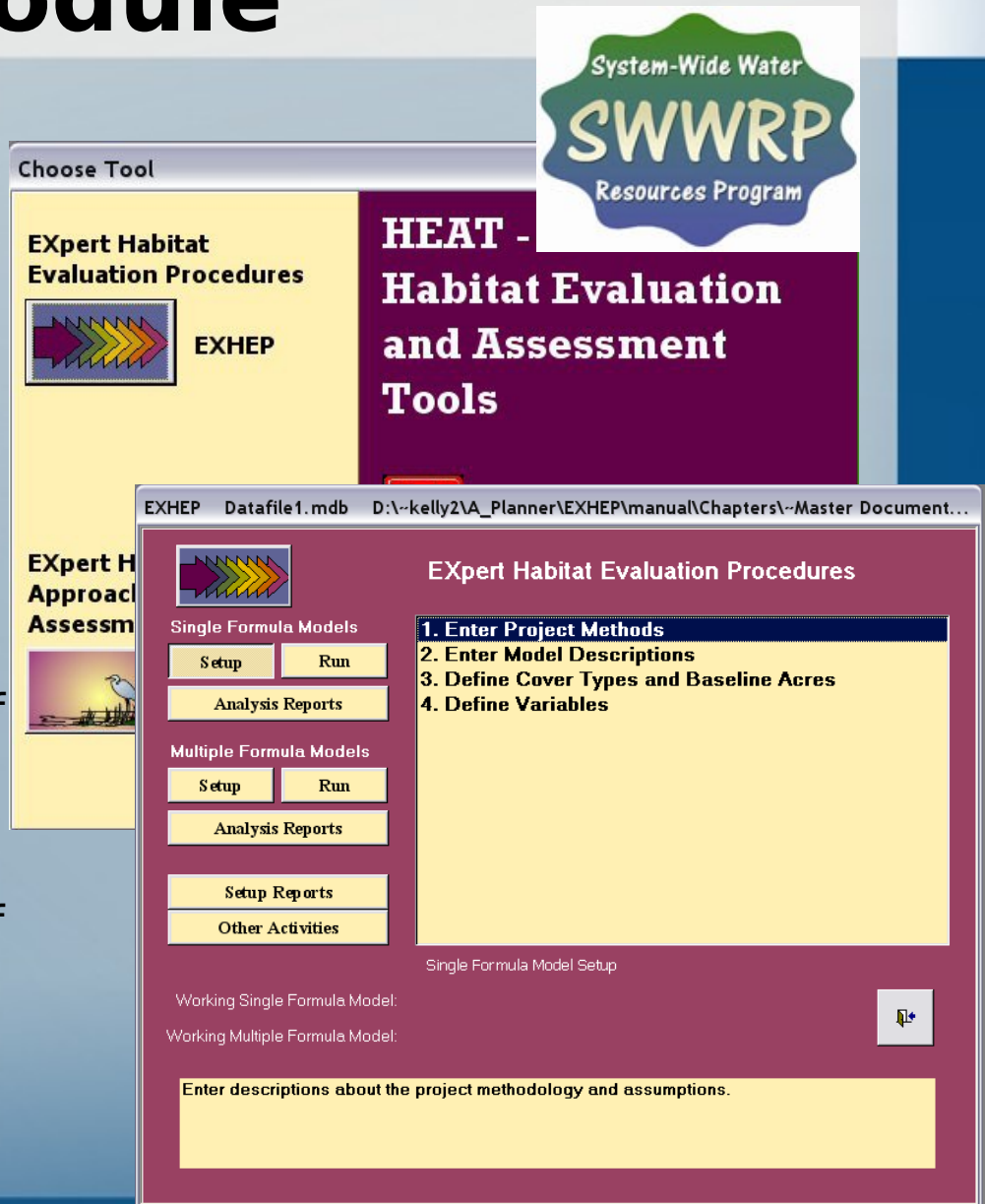
Acres = 337

HUs = 204

HEAT Software and EXHEP Module

- HEAT Software:
  See System-wide Water Resources Research Program Booth

- EXHEP Module:
  - Quantifies conditions using standard HEP techniques
  - Incorporates a broad range of HEP models
  - Processes large amounts of data quickly and efficiently
  - Adapts to regional variation
  - Accommodates a variety of data formats



Flood Damage Reduction (NED)

Phase I – 26 Components Considered
– Conveyance, detention, clearing/snagging, buyouts, etc.
– 10 carried to Phase II

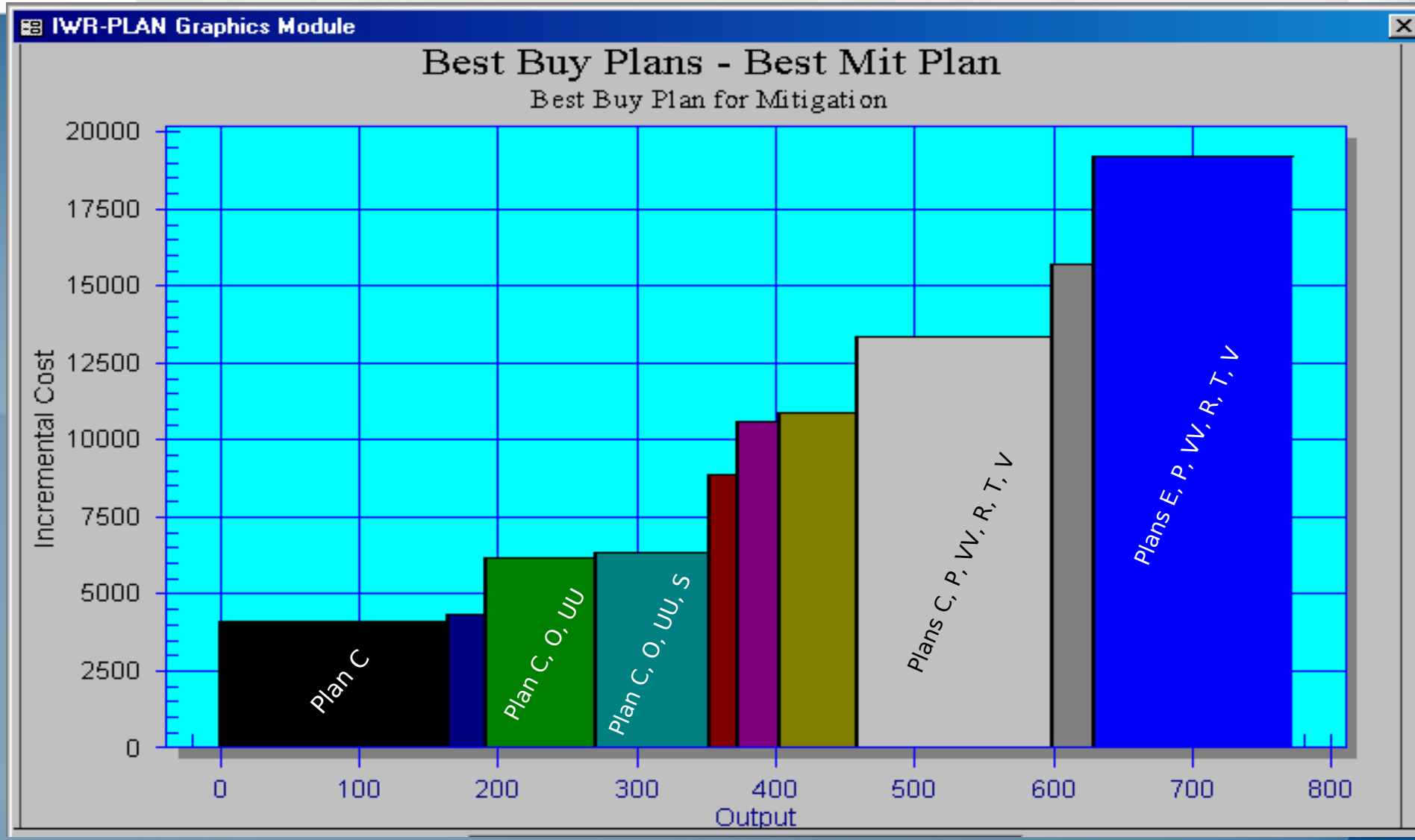
Phase II – 19 Components Considered, 8 survived as preliminary NED Plan
– HEP analysis performed on these 8 to determine actual mitigation and refine NED costs
– One component fell out as a result of high mitigation requirements and costs

NED Plan – 7 Components made up of conveyance and detention

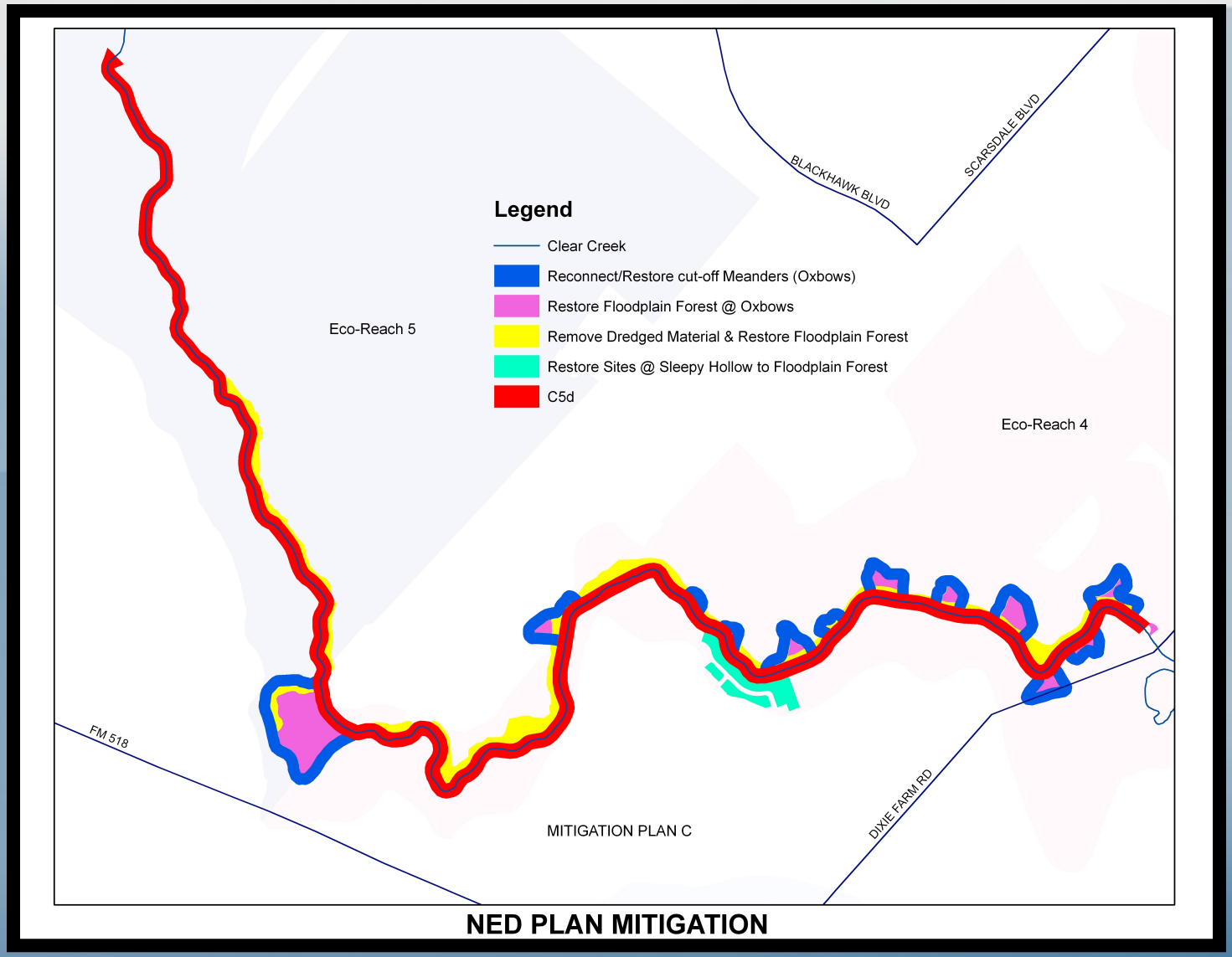
Mitigation Plans

- Constraint
  - A minimum of 153 Average Annual Habitat Units (AAHUs) required for full Mitigation
- 16 components considered
  - Preservation
  - Enhancement
  - Creation
- IWR Results
  - 1280 Actual Combinations
  - 63 Cost Effective Plans
  - 10 Best Buy Plans

Best Buy Mitigation Plans



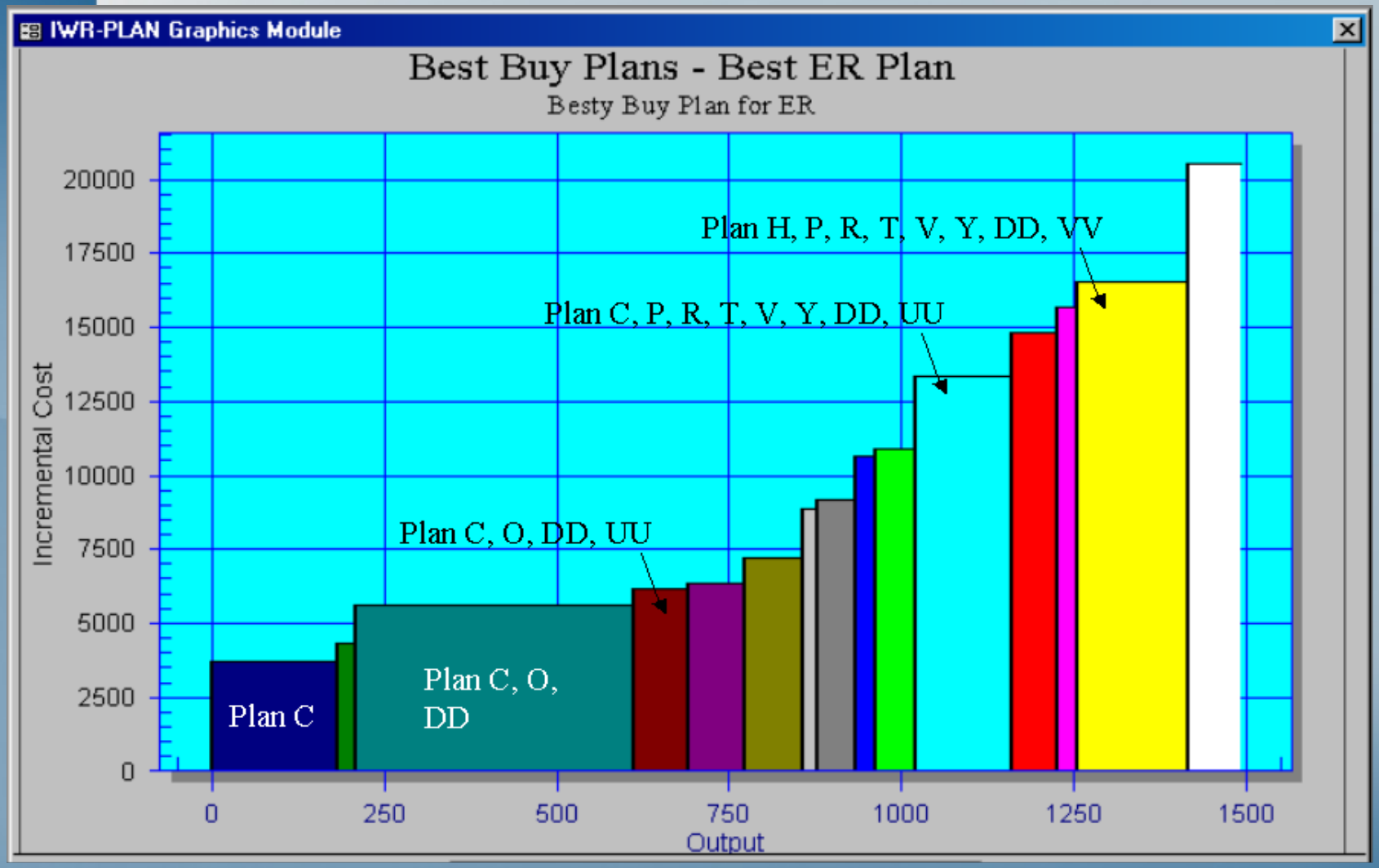
NED Mitigation
Plan C – 164 AAHUs



Ecosystem Restoration Opportunities

- 35 components considered
  - Preservation,
  - Enhancement,
  - Creation
- IWR Results
  - 102,505 Actual Combinations
  - 147 Cost Effective Plans
  - 16 Best Buy Plans

NER Plan


IWR-PLAN Graphics Module
Best Buy Plans - Best ER Plan
Besty Buy Plan for ER
Incremental Cost
20000
17500
15000
12500
10000
7500
5000
2500
0
0
250
500
750
1000
1250
1500
Output
Plan C
Plan C, O, DD
Plan C, O, DD, UU
Plan C, P, R, T, V, Y, DD, UU
Plan H, P, R, T, V, Y, DD, VV

NER Plan
613 AAHUs

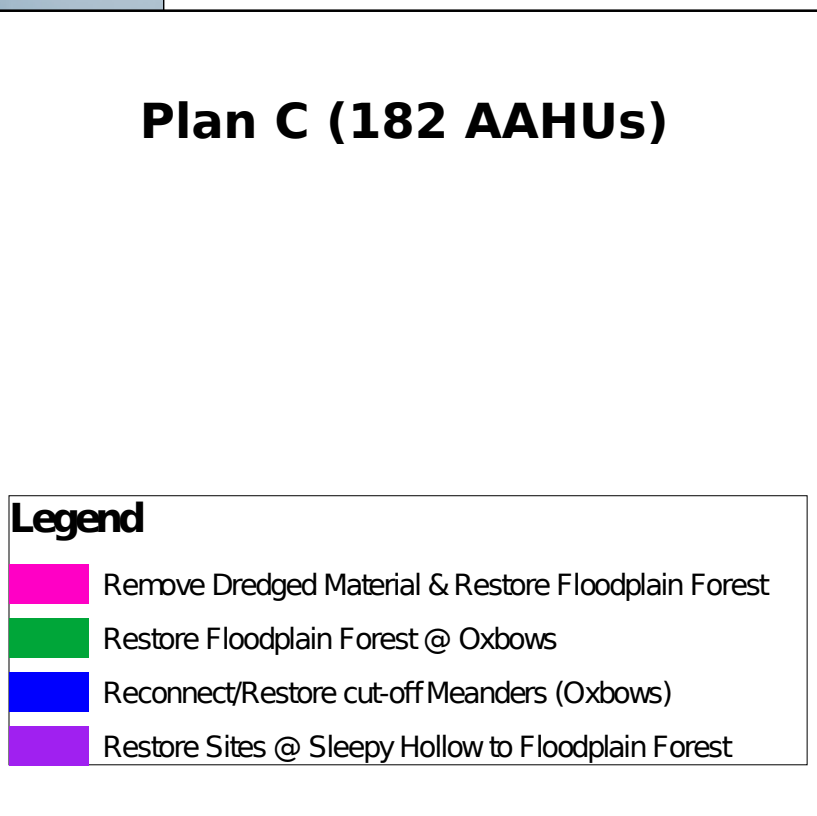
Plan O (28 AAHUs)

Preserve Floodplain Forest

Plan C (182 AAHUs)

Plan DD (403 AAHUs) –

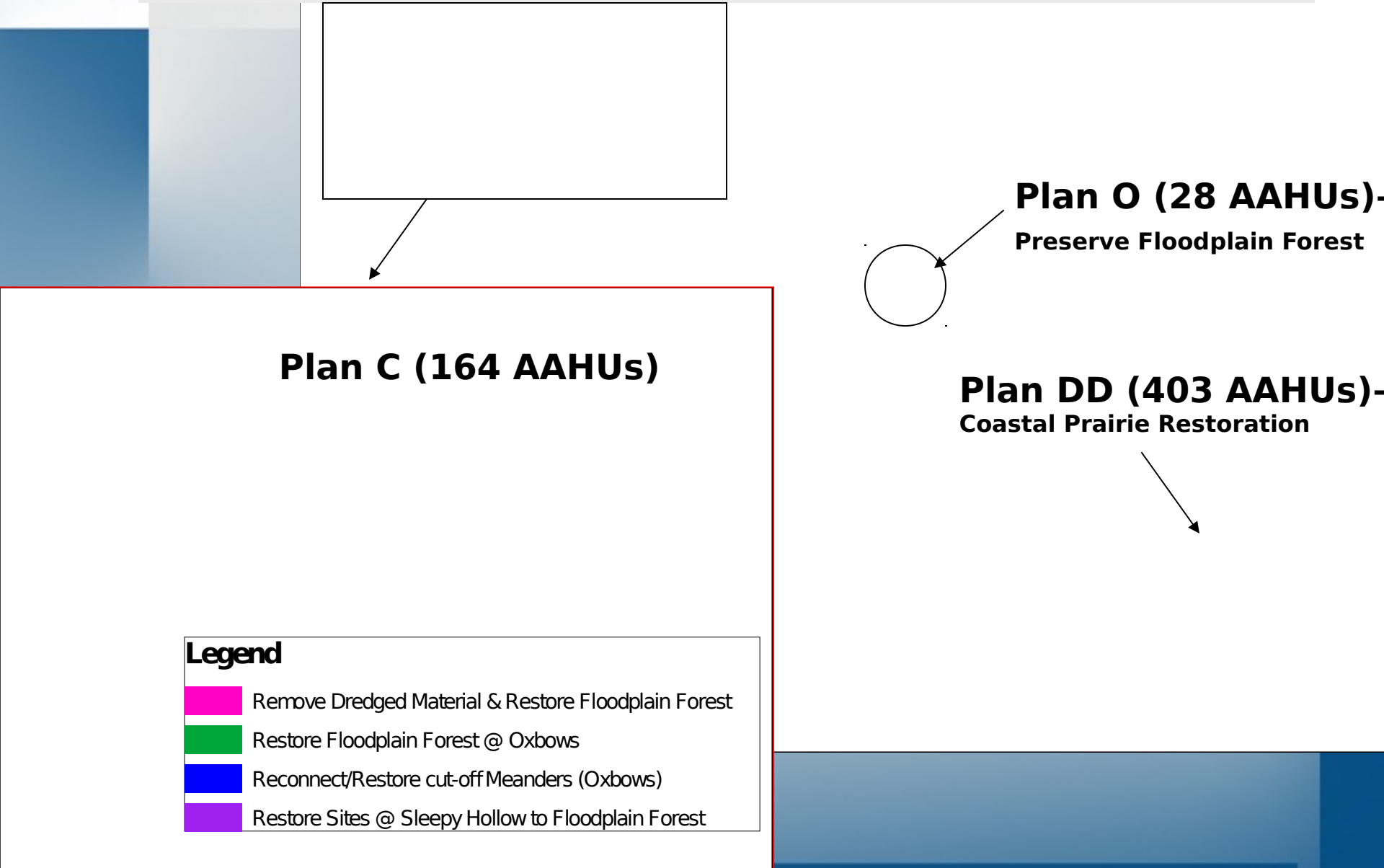
Coastal Prairie Restoration


Legend
Remove Dredged Material & Restore Floodplain Forest
Restore Floodplain Forest @ Oxbows
Reconnect/Restore cut-off Meanders (Oxbows)
Restore Sites @ Sleepy Hollow to Floodplain Forest

NED/NER Combined Plan

- All NED Flood Damage Reduction Components were retained in the plan
- Mitigation Plan C (162 AAHUs) occupies the exact footprint of Restoration Plan C (184 AAHUs), mutually exclusive
- NED/NER Plan – Plan C (mitigation), Plans O & DD (restoration) = 595 AAHUs

NED/NER Combined Plan
595 AAHUs


Plan O (28 AAHUs)-
Preserve Floodplain Forest
Plan C (164 AAHUs)
Plan DD (403 AAHUs)-
Coastal Prairie Restoration
Legend
Remove Dredged Material & Restore Floodplain Forest
Restore Floodplain Forest @ Oxbows
Reconnect/Restore cut-off Meanders (Oxbows)
Restore Sites @ Sleepy Hollow to Floodplain Forest

What's Next?

- Refinements to NED, NER, and NED/NER Combined Plans
- Looking at a possible LPP
- ITR (Formulation, Plans, Models, Economics)
- AFB

Key Takeaway Points

- In an NED-NER Formulation Effort, wait until the NED is done before assessing impacts (use proxy for mitigation requirements)
- Use Community models – this reduces the number of models you need to fully assess the study area
- Use existing models if possible and adapt them to meet the needs of the study
- Involve stakeholders in the modeling process from the very beginning – for buy-in and “ownership” of models
- Involve H&H / Engineering, Regulatory, and GIS early in the Environmental analysis
- ICT may slow front-end planning, but pays off in agency ownership and should help during review process